#### **Product data sheet**



### 1. General description

The 74LVC1G04 provides one inverting buffer.

Input can be driven from either 3.3 V or 5 V devices. These features allow the use of these devices in a mixed 3.3 V and 5 V environment.

Schmitt-trigger action at all inputs makes the circuit tolerant of slower input rise and fall time.

This device is fully specified for partial power-down applications using  $I_{OFF}$ . The  $I_{OFF}$  circuitry disables the output, preventing the damaging backflow current through the device when it is powered down.

### 2. Features and benefits

- Wide supply voltage range from 1.65 V to 5.5 V
- 5 V tolerant inputs for interfacing with 5 V logic
- High noise immunity
- Complies with JEDEC standard:
  - JESD8-7 (1.65 V to 1.95 V)
  - ◆ JESD8-5 (2.3 V to 2.7 V)
  - ◆ JESD8-B/JESD36 (2.7 V to 3.6 V)
- ESD protection:
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V
- $\pm 24$  mA output drive (V<sub>CC</sub> = 3.0 V)
- CMOS low power consumption
- Latch-up performance exceeds 250 mA
- Direct interface with TTL levels
- Inputs accept voltages up to 5 V
- Multiple package options
- Specified from -40 °C to +85 °C and -40 °C to +125 °C.



Single inverter

#### **Ordering information** 3.

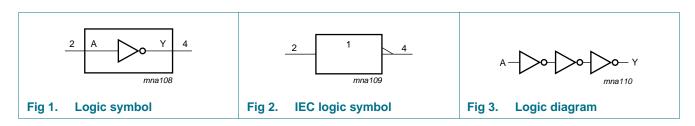
Table 1. Ordering	g information			
Type number	Package			
	Temperature range	Name	Description	Version
74LVC1G04GW	–40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74LVC1G04GV	–40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753
74LVC1G04GM	–40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 $\times$ 1.45 $\times$ 0.5 mm	SOT886
74LVC1G04GF	–40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 $\times$ 1 $\times$ 0.5 mm	SOT891
74LVC1G04GN	–40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body $0.9 \times 1.0 \times 0.35$ mm	SOT1115
74LVC1G04GS	–40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body $1.0 \times 1.0 \times 0.35$ mm	SOT1202
74LVC1G04GX	–40 °C to +125 °C	X2SON5	X2SON5: plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body $0.8 \times 0.8 \times 0.35$ mm	SOT1226

#### Marking 4.

Table 2. Marking	
Type number	Marking code <sup>[1]</sup>
74LVC1G04GW	VC
74LVC1G04GV	V04
74LVC1G04GM	VC
74LVC1G04GF	VC
74LVC1G04GN	VC
74LVC1G04GS	VC
74LVC1G04GX	VC

[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

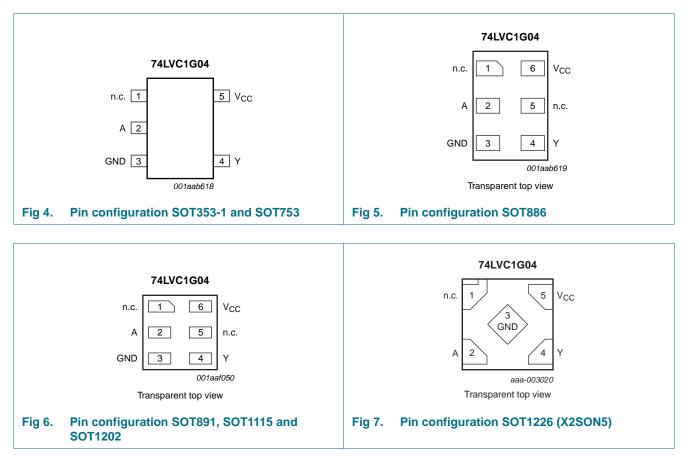
#### **Functional diagram** 5.



74LVC1G04 Product data sheet

# 6. Pinning information

### 6.1 Pinning



### 6.2 Pin description

Symbol	Pin		Description	
	TSSOP5 and X2SON5	XSON6		
n.c.	1	1	not connected	
A	2	2	data input	
GND	3	3	ground (0 V)	
Y	4	4	data output	
n.c.	-	5	not connected	
V <sub>cc</sub>	5	6	supply voltage	

## 7. Functional description

Input	Output
Α	Y
L	Н
Н	L

[1] H = HIGH voltage level; L = LOW voltage level

## 8. Limiting values

#### Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Max	Unit
V <sub>CC</sub>	supply voltage		-0.5	+6.5	V
I <sub>IK</sub>	input clamping current	V <sub>I</sub> < 0 V	-50	-	mA
VI	input voltage		<u>[1]</u> –0.5	+6.5	V
Ι <sub>ΟΚ</sub>	output clamping current	$V_{\rm O}$ > $V_{\rm CC}$ or $V_{\rm O}$ < 0 V	-	±50	mA
Vo	output voltage	Active mode	[1][2] -0.5	$V_{CC} + 0.5$	V
		Power-down mode	<u>[1][2]</u> –0.5	+6.5	V
Ι <sub>Ο</sub>	output current	$V_{O} = 0$ to $V_{CC}$	-	±50	mA
I <sub>CC</sub>	supply current		-	100	mA
I <sub>GND</sub>	ground current		-100	-	mA
P <sub>tot</sub>	total power dissipation	$T_{amb}$ = -40 °C to +125 °C	[3]	250	mW
T <sub>stg</sub>	storage temperature		-65	+150	°C

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] When  $V_{CC} = 0 V$  (Power-down mode), the output voltage can be 5.5 V in normal operation.

[3] For TSSOP5 and SC-74A packages: above 87.5 °C the value of P<sub>tot</sub> derates linearly with 4.0 mW/K. For XSON6 and X2SON5 packages: above 118 °C the value of P<sub>tot</sub> derates linearly with 7.8 mW/K.

# 9. Recommended operating conditions

Table 6.	Recommended operating conditions								
Symbol	Parameter	Conditions	Min	Тур	Max	Unit			
V <sub>CC</sub>	supply voltage		1.65	-	5.5	V			
VI	input voltage		0	-	5.5	V			
Vo	output voltage	Active mode	0	-	V <sub>CC</sub>	Vo			
		$V_{CC} = 0 V$ ; Power-down mode	0	-	5.5	Vo			
T <sub>amb</sub>	ambient temperature		-40	-	+125	°C			
$\Delta t/\Delta V$	input transition rise and fall rate	$V_{CC}$ = 1.65 V to 2.7 V	-	-	20	ns/V			
		$V_{CC}$ = 2.7 V to 5.5 V	-	-	10	ns/V			

Single inverter

# **10. Static characteristics**

### Table 7. Static characteristics

At recommended operating conditions. Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ <mark>[1]</mark>	Max	Unit
T <sub>amb</sub> = -	40 °C to +85 °C					
VIH	HIGH-level input voltage	$V_{CC}$ = 1.65 V to 1.95 V	$0.65 \times V_{CC}$	-	-	V
		$V_{CC}$ = 2.3 V to 2.7 V	1.7	-	-	V
		$V_{CC}$ = 2.7 V to 3.6 V	2.0	-	-	V
		$V_{CC}$ = 4.5 V to 5.5 V	$0.7\times V_{CC}$	-	-	V
VIL	LOW-level input voltage	$V_{CC} = 1.65 \text{ V to } 1.95 \text{ V}$	-	-	$0.35 \times V_{CC}$	V
		$V_{CC}$ = 2.3 V to 2.7 V	-	-	0.7	V
		$V_{CC}$ = 2.7 V to 3.6 V	-	-	0.8	V
		$V_{CC}$ = 4.5 V to 5.5 V	-	-	$0.3\times V_{CC}$	V
V <sub>OH</sub> HIGH-level output voltage		$V_I = V_{IH} \text{ or } V_{IL}$				
		$I_{O}$ = –100 $\mu A;$ $V_{CC}$ = 1.65 V to 5.5 V	$V_{CC}-0.1$	-	-	V
		$I_{O} = -4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	1.2	-	-	V
		$I_{O} = -8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	1.9	-	-	V
		$I_0 = -12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	2.2	-	-	V
		$I_{O} = -24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.3	-	-	V
		$I_{O} = -32 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.8	-	-	V
V <sub>OL</sub>	LOW-level output voltage	$V_I = V_{IH} \text{ or } V_{IL}$				
		$I_{O}$ = 100 $\mu$ A; $V_{CC}$ = 1.65 V to 5.5 V	-	-	0.1	V
		$I_0 = 4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	-	-	0.45	V
		$I_0 = 8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	-	-	0.3	V
		$I_0 = 12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	-	-	0.4	V
		$I_{O} = 24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.55	V
		$I_{O} = 32 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	-	0.55	V
<sub> </sub>	input leakage current	$V_{CC}$ = 0 V to 5.5 V; $V_{I}$ = 5.5 V or GND	-	±0.1	±5	μA
OFF	power-off leakage current	$V_{CC}$ = 0 V; V <sub>I</sub> or V <sub>O</sub> = 5.5 V	-	±0.1	±10	μA
СС	supply current	$V_{I} = 5.5 V \text{ or GND};$ $V_{CC} = 1.65 V \text{ to } 5.5 V; I_{O} = 0 A$	-	0.1	10	μA
∆I <sub>CC</sub>	additional supply current	per pin; $V_{CC} = 2.3 \text{ V}$ to 5.5 V; $V_I = V_{CC} - 0.6 \text{ V}$ ; $I_O = 0 \text{ A}$	-	5	500	μΑ
CI	input capacitance	$V_{CC}$ = 3.3 V; $V_{I}$ = GND to $V_{CC}$	-	5	-	pF

**Single inverter** 

At recommended operating conditions. Voltages are referenced to $GND$ (ground = 0 V).						
Symbol	Parameter	Conditions	Min	Typ <mark>[1]</mark>	Max	Unit
T <sub>amb</sub> = –	40 °C to +125 °C					
VIH	HIGH-level input voltage	$V_{CC}$ = 1.65 V to 1.95 V	$0.65 \times V_{CC}$	-	-	V
		$V_{CC}$ = 2.3 V to 2.7 V	1.7	-	-	V
		$V_{CC}$ = 2.7 V to 3.6 V	2.0	-	-	V
		$V_{CC}$ = 4.5 V to 5.5 V	$0.7\times V_{CC}$	-	-	V
V <sub>IL</sub>	LOW-level input voltage	$V_{CC}$ = 1.65 V to 1.95 V	-	-	$0.35 \times V_{CC}$	V
		$V_{CC}$ = 2.3 V to 2.7 V	-	-	0.7	V
		$V_{CC}$ = 2.7 V to 3.6 V	-	-	0.8	V
		$V_{CC}$ = 4.5 V to 5.5 V	-	-	$0.3\times V_{CC}$	V
V <sub>OH</sub>	HIGH-level output voltage	$V_{I} = V_{IH} \text{ or } V_{IL}$				
		$I_{O}$ = –100 $\mu A;$ $V_{CC}$ = 1.65 V to 5.5 V	$V_{CC}-0.1$	-	-	V
		$I_{O} = -4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	0.95	-	-	V
		$I_{O} = -8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	1.7	-	-	V
		$I_{O} = -12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	1.9	-	-	V
		$I_0 = -24$ mA; $V_{CC} = 3.0$ V	2.0	-	-	V
		$I_{O} = -32 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.4	-	-	V
V <sub>OL</sub>	LOW-level output voltage	$V_{I} = V_{IH} \text{ or } V_{IL}$				
		$I_{O}$ = 100 $\mu$ A; $V_{CC}$ = 1.65 V to 5.5 V	-	-	0.1	V
		$I_0 = 4 \text{ mA}; V_{CC} = 1.65 \text{ V}$	-	-	0.70	V
		$I_0 = 8 \text{ mA}; V_{CC} = 2.3 \text{ V}$	-	-	0.45	V
		$I_0 = 12 \text{ mA}; V_{CC} = 2.7 \text{ V}$	-	-	0.60	V
		$I_0 = 24 \text{ mA}; V_{CC} = 3.0 \text{ V}$	-	-	0.80	V
		$I_0 = 32 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	-	0.80	V
I <sub>I</sub>	input leakage current	$V_{CC}$ = 0 V to 5.5 V; $V_{I}$ = 5.5 V or GND	-	-	±100	μA
I <sub>OFF</sub>	power-off leakage current	$V_{CC} = 0 \text{ V}; \text{ V}_{I} \text{ or } \text{ V}_{O} = 5.5 \text{ V}$	-	-	±200	μA
I <sub>CC</sub>	supply current	$V_{I} = 5.5 V \text{ or GND};$ $V_{CC} = 1.65 V \text{ to } 5.5 V; I_{O} = 0 A$	-	-	200	μA
$\Delta I_{CC}$	additional supply current	per pin; $V_{CC} = 2.3 \text{ V}$ to 5.5 V; $V_I = V_{CC} - 0.6 \text{ V}$ ; $I_O = 0 \text{ A}$	-	-	5000	μA

#### Static characteristics ... continued Table 7.

foreneed to CND (areund 0.)()

[1] All typical values are measured at V\_{CC} = 3.3 V and T\_{amb} = 25 °C.

# **11. Dynamic characteristics**

#### Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit see Figure 9.

Symbol	Parameter	Conditions		-40	°C to +85	°C	–40 °C to	o +125 ℃	Unit
				Min	Typ <mark>[1]</mark>	Max	Min	Max	
t <sub>pd</sub>	propagation delay	A to Y; see Figure 8	[2]						
		$V_{CC}$ = 1.65 V to 1.95 V		1.0	3.0	7.5	1.0	9.5	ns
		$V_{CC}$ = 2.3 V to 2.7 V		0.5	2.0	5.0	0.5	6.5	ns
		$V_{CC} = 2.7 V$		0.5	2.3	5.2	0.5	7.0	ns
		$V_{CC} = 3.0 \text{ V} \text{ to } 3.6 \text{ V}$		0.5	2.0	4.2	0.5	5.5	ns
		$V_{CC} = 4.5 V$ to 5.5 V		0.5	1.6	3.7	0.5	5.0	ns
C <sub>PD</sub>	power dissipation capacitance	$V_{\rm I}$ = GND to $V_{CC};V_{CC}$ = 3.3 V	<u>[3]</u>	-	14	-	-	-	pF

[1] Typical values are measured at  $T_{amb}$  = 25 °C and V<sub>CC</sub> = 1.8 V, 2.5 V, 2.7 V, 3.3 V and 5.0 V respectively.

[2]  $t_{pd}$  is the same as  $t_{PLH}$  and  $t_{PHL}$ .

[3]  $C_{PD}$  is used to determine the dynamic power dissipation (P<sub>D</sub> in  $\mu$ W).

 $\mathsf{P}_{D}=C_{PD}\times\mathsf{V}_{CC}{}^{2}\times\mathsf{f}_{i}\times\mathsf{N}+\sum(C_{L}\times\mathsf{V}_{CC}{}^{2}\times\mathsf{f}_{o})$  where:

 $f_i$  = input frequency in MHz;

f<sub>o</sub> = output frequency in MHz;

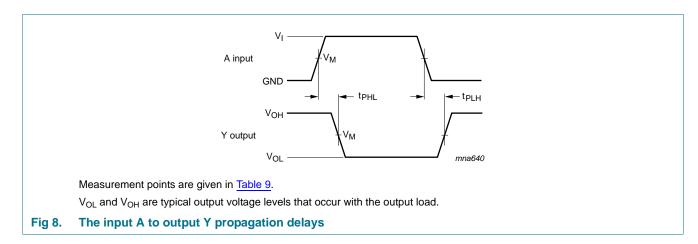
 $C_L$  = output load capacitance in pF;

 $V_{CC}$  = supply voltage in V;

N = number of inputs switching;

 $\Sigma(C_L \times V_{CC}{}^2 \times f_o)$  = sum of outputs.

## 12. AC waveforms



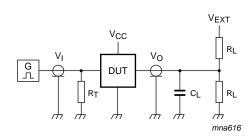
### **NXP Semiconductors**

# 74LVC1G04

Single inverter

#### Table 9.Measurement points

Supply voltage	Input	Output
V <sub>cc</sub>	V <sub>M</sub>	V <sub>M</sub>
1.65 V to 1.95 V	$0.5  imes V_{CC}$	$0.5  imes V_{CC}$
2.3 V to 2.7 V	$0.5  imes V_{CC}$	$0.5  imes V_{CC}$
2.7 V	1.5 V	1.5 V
3.0 V to 3.6 V	1.5 V	1.5 V
4.5 V to 5.5 V	$0.5  imes V_{CC}$	$0.5  imes V_{CC}$



Test data is given in Table 10.

Definitions for test circuit:

R<sub>L</sub> = Load resistance.

 $C_L$  = Load capacitance including jig and probe capacitance.

 $R_T$  = Termination resistance should be equal to the output impedance  $Z_0$  of the pulse generator.

 $V_{EXT}$  = External voltage for measuring switching times.

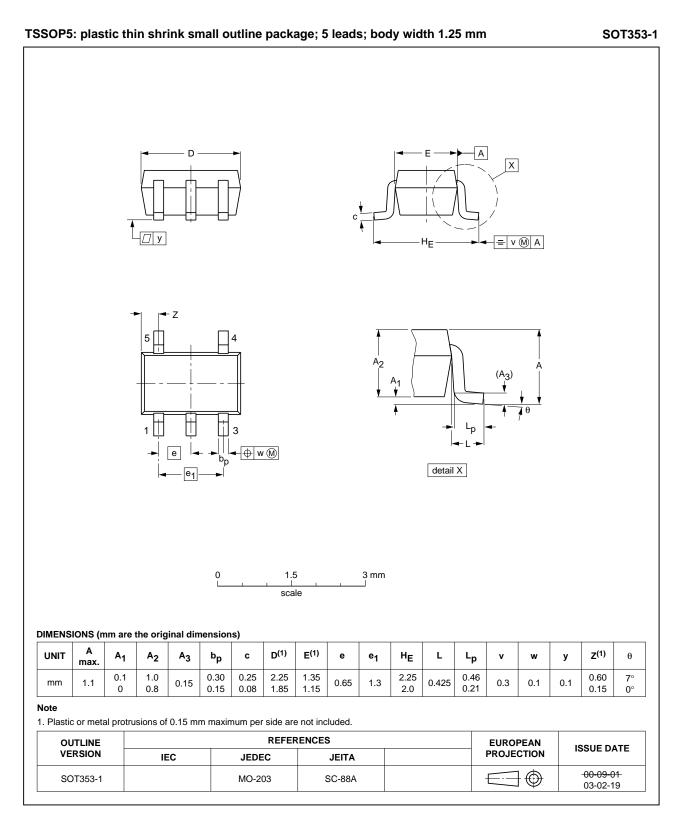
Fig 9. Test circuit for measuring switching times

#### Table 10. Test data

Supply voltage	Input		Load	V <sub>EXT</sub>	
V <sub>CC</sub>	VI	$t_r = t_f$	CL	RL	t <sub>PLH</sub> , t <sub>PHL</sub>
1.65 V to 1.95 V	V <sub>CC</sub>	$\leq$ 2.0 ns	30 pF	1 kΩ	open
2.3 V to 2.7 V	V <sub>CC</sub>	$\leq$ 2.0 ns	30 pF	500 Ω	open
2.7 V	2.7 V	$\leq$ 2.5 ns	50 pF	500 Ω	open
3.0 V to 3.6 V	2.7 V	$\leq$ 2.5 ns	50 pF	500 Ω	open
4.5 V to 5.5 V	V <sub>CC</sub>	$\leq$ 2.5 ns	50 pF	500 Ω	open

Single inverter

## 13. Package outline



#### Fig 10. Package outline SOT353-1 (TSSOP5)

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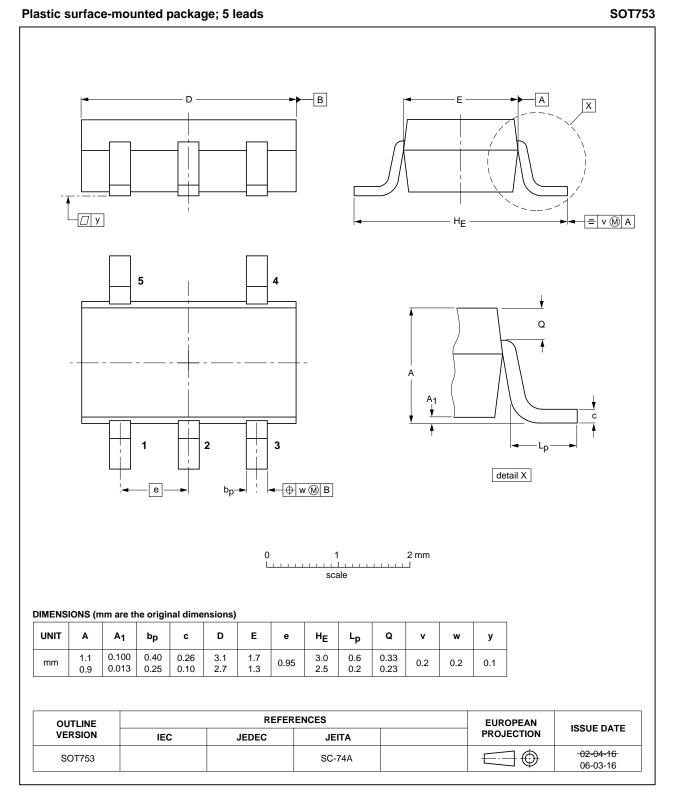
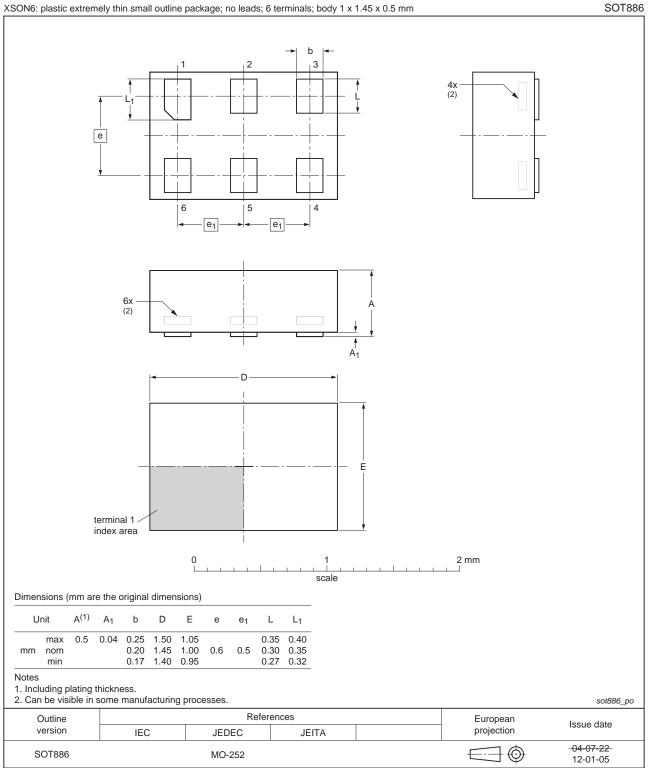


Fig 11. Package outline SOT753 (SC-74A)

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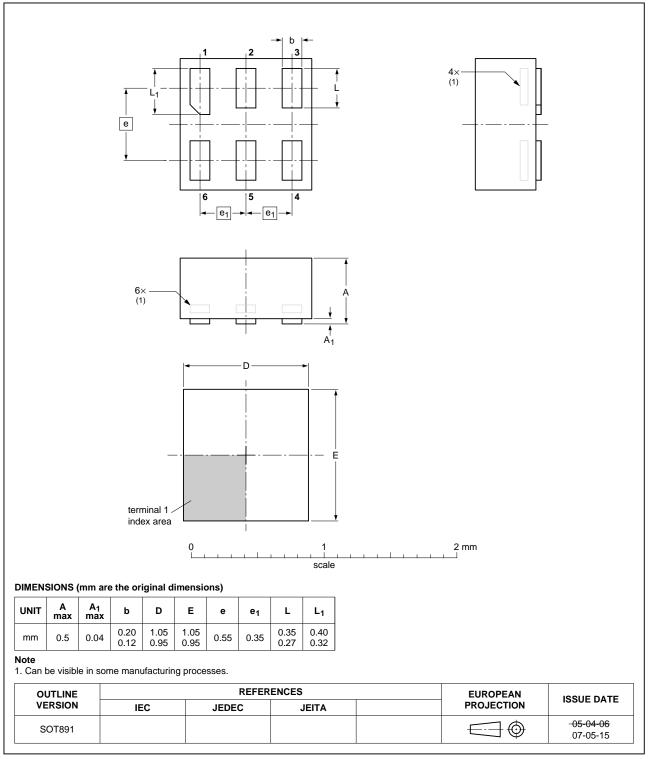


# XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm

Fig 12. Package outline SOT886 (XSON6)

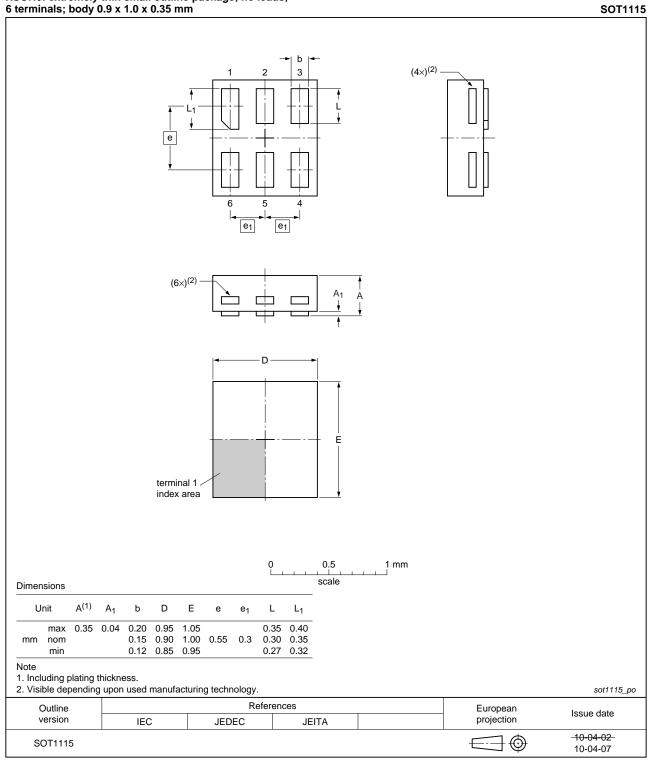
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SOT891



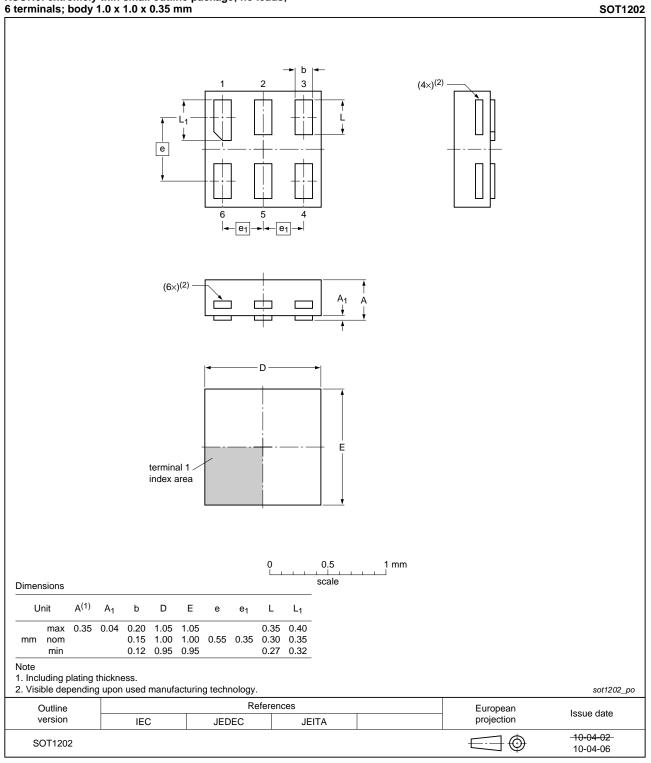
# XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1 x 0.5 mm

Fig 13. Package outline SOT891 (XSON6)



# XSON6: extremely thin small outline package; no leads; 6 terminals; body 0.9 x 1.0 x 0.35 mm

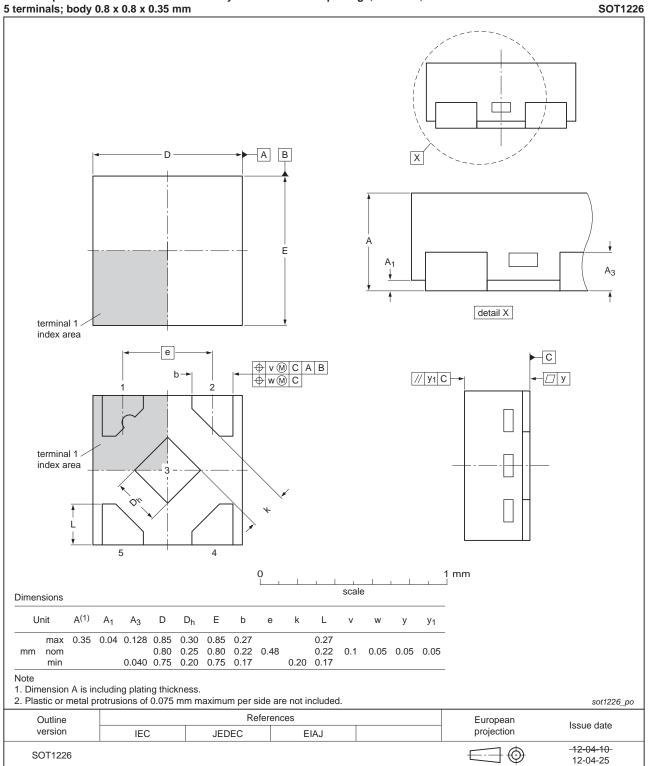
Fig 14. Package outline SOT1115 (XSON6)



XSON6: extremely thin small outline package; no leads; 6 terminals; body 1.0 x 1.0 x 0.35 mm

Fig 15. Package outline SOT1202 (XSON6)

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X2SON5: plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body 0.8 x 0.8 x 0.35 mm

#### Fig 16. Package outline SOT1226 (X2SON5)

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# 14. Abbreviations

Table 11. Abbreviations				
Description				
Complementary Metal Oxide Semiconductor				
Device Under Test				
ElectroStatic Discharge				
Human Body Model				
Machine Model				
Transistor-Transistor Logic				

# **15. Revision history**

#### Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC1G04 v.12	20120806	Product data sheet	-	74LVC1G04 v.11
Modifications:	<ul> <li>Package outline</li> </ul>	ine drawing of SOT1226 ( <mark>Figu</mark>	re 16) modified.	
74LVC1G04 v.11	20120412	Product data sheet	-	74LVC1G04 v.10
Modifications:	<ul> <li>Added type n</li> </ul>	umber 74LVC1G04GX (SOT12	226)	
	<ul> <li>Package outling</li> </ul>	ine drawing of SOT886 ( <mark>Figure</mark>	e 12) modified.	
74LVC1G04 v.10	20111207	Product data sheet	-	74LVC1G04 v.9
Modifications:	<ul> <li>Legal pages</li> </ul>	updated.		
74LVC1G04 v.9	20101026	Product data sheet	-	74LVC1G04 v.8
74LVC1G04 v.8	20090427	Product data sheet	-	74LVC1G04 v.7
74LVC1G04 v.7	20070827	Product data sheet	-	74LVC1G04 v.6
74LVC1G04 v.6	20070202	Product data sheet	-	74LVC1G04 v.5
74LVC1G04 v.5	20040907	Product specification	-	74LVC1G04 v.4
74LVC1G04 v.4	20021002	Product specification	-	74LVC1G04 v.3
74LVC1G04 v.3	20020513	Product specification	-	74LVC1G04 v.2
74LVC1G04 v.2	20010119	Product specification	-	74LVC1G04 v.1
74LVC1G04 v.1	20011121	Product specification	-	-
		•		

## 16. Legal information

#### 16.1 Data sheet status

Document status[1][2]	Product status <sup>[3]</sup>	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <a href="http://www.nxp.com">http://www.nxp.com</a>.

#### 16.2 Definitions

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